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ABSTRACT

Two experiments were conducted to determine whether children remembered information more efficiently if they were provided with an explicit purpose for learning. In the first experiment, 96 5-year-old children watched a simple science demonstration and were told either to remember the names of the depicted items from pictures for a memory test (rote memory group), to learn the names of the items because they were needed for a second science demonstration (embedded memory group), or to tell the experimenter whether they thought they had seen the pictures anywhere before (incidental memory group). Except for the incidental memory group, all subjects were told that their recall would be tested immediately or after a one-hour delay. Results indicated that children in the embedded group employed mnemonic strategies (rehearsal, elaboration) more frequently and studied longer than children in other groups, but only children tested immediately recalled more. The second experiment, using the same set of materials and procedures with 65 5-year-old children from the same population source, investigated whether omitting mention of the time the children would have to remember would minimize their concern and, in turn, lead to elevated recall. Under this condition, the performance of the embedded delay and the embedded immediate groups was equivalent. These data show that 5-year-old children can use task appropriate strategies if the memory task is embedded in a purposeful, motivating activity, but the effort is dependent on the nature of the task content and other factors, such as doubts about one's competence, which may intervene and affect performance. (EL)

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Technical Report No. 346

EFFECT OF TASK PURPOSE ON THE STUDY BEHAVIORS AND RECALL OF YOUNG CHILDREN

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Abstract

The performance strategies of 5-year-old children required to remember information embedded in a meaningful context was compared with that of children who were simply told to remember the information, or were not told their memory would be assessed. Recall was tested either immediately or after a one-hour delay. Children in the "embedded" groups employed mnemonic strategies more frequently and studied longer before judging learning to be complete than children in other groups, but only children tested immediately recalled more. One hypothesis for the poor retention of children in the "embedded delay" group was that they recognized the difficulty of remembering over an extended interval; this was tested in Study 2 where no mention was made of the retention interval over which children would have to remember. Under these conditions, the performance of the "embedded delay" and the "embedded immediate" groups was equivalent. Overall, children made more effort to learn if they were provided with an explicit purpose for learning.

The Effect of Task Purpose on the Recall and Study Behaviors of Young Children

One of the most frequently demonstrated findings in the developmental memory literature is that as children get older they are more likely to use classic mnemonic strategies (rehearsal, elaboration) spontaneously to aid their retention (Brown & DeLoache, 1978; Brown, Bransford, Ferrara, & Campione, 1983; Flavell, 1977). Indeed, the superior performance of older individuals on deliberate memory tasks has typically been attributed to their "more planful, more strategic, intentional behavior" (Wellman, 1977a, p. 86), and the performance of young children has been ascribed to their "passive, nonstrategic, and nonplanful behavior" (Brown et al., 1983, p. 88). Although the relation between mnemonic strategies and memory performance is well documented, still relatively little is known about the factors that promote the emergence and development of strategic behavior, especially in tasks which require the retention and recall of unrelated items (Kail, 1984; Naus & Ornstein, 1983).

One view of strategy development is that the spontaneous use of mnemonic skills first emerges in the context of day-to-day meaningful events (e.g., remembering the rules of a game, or the names of items so they can be bought at the store); that is, effortful attempts to remember first emerge in tasks which are embedded in familiar everyday contexts (Brown, 1975, 1979; Donaldson, 1978; Paris, 1978; Smirnov & Zinchenko, 1969).

Often cited in support of this position is research conducted in Russia almost 30 years ago (Istomina, 1948/1975). In Istomina's task, children between 3- and 6-years-old were either required to go to their school store and collect some items for the cook (sugar, spoons, etc.), or attempt to remember the same set of items for a rote memory test. Two interesting findings emerged from Istomina's research; first, she found that children who collected items for the cook remembered more than children receiving the rote memory test; second, she observed that children given the more meaningful task engaged in mnemonic strategies spontaneously (e.g., item rehearsal) more frequently than children who remembered under rote instructions.

Unfortunately Istomina made no attempt to document the quality or the quantity of strategic activity, nor to relate strategies to recall performance directly. Nonetheless, her results are intriguing because they suggest that embedding a memory task in a meaningful activity not only facilitates the spontaneous use of mnemonic strategies, but it may also affect the cognitive effort children invest in remembering.

Two related hypotheses may be advanced to account for the more effortful use of mnemonic strategies in Istomina's meaningful task. One hypothesis is that the provision of a familiar problem with an explicit purpose helped children to coordinate their mnemonic activity to fulfill the goal of remembering items for the cook (Paris, 1978); that is, it provided a supportive schema

(Anderson, 1984) or "scaffold" (Brown & Reeve, in press; Woods, & Middleton, 1975), which reduced the cognitiv. processing load, allowing additional cognitive activity to occur. Consistent with this position, several studies have shown that young children show a propensity to be strategic in situations where the goal of the task is clear to the child and the setting familiar (e.g., DeLoache, Cassidy, & Brown, 1985; Wellman, Ritter, & Flavell, 1975). However, these studies have typically used relatively simple tasks (e.g., remembering under which cup something is hidden, searching for a lost toy), and have also adopted more lenient indices of strategy use than those required to facilitate rote recall.

A second hypothesis is that children's knowledge of what it means "to collect things for another person" facilitated their cognitive processing. A number of researchers have claimed that the ability to use mnemonic and metacognitive strategies is affected by one's knowledge (Bransford, 1979; Brown et al., 1983; Chi, 1978; Chi & Rees, 1983; Lindberg, 1980). Chi (1978), for example, has shown that, in contrast to novice adult chess players, experienced 10-year-old chess players not only reconstructed a legitimate chess game more accurately, but they also exhibited superior metacognitive abilities; the meta-cognitive task required subjects to predict how many chess pieces they would be able to replace on a chess board after viewing legitimate and illegitimate chess games. When the same subjects

performed a digit span task, both recall and metamemory performance was correlated with age. Chi's (1978) data, then, provides evidence in support of the claim that knowledge facilitates recall and metacognitive abilities, independent of age (see also Chi & Koeske, 1983). However, because Chi's subjects were substantially older than Istomina's sample, it is difficult to draw firm conclusions about the emergence of mnemonic or metacognitive strategies from these data.

The problems of assessing young children's metacognitive abilities has been the source of recent critical debate (Brown et al., 1983; Cavanaugh & Perlmutter, 1982; Flavell, 1981; Wellman, 1983), much of which has focussed on the difficulty of identifying the circumstances under which one would expect a link between metacognition and performance. Brown et al. (1983) consider that, in contrast to verbal reports, "on-line" methods of assessing metacognitive activity are more likely to provide sensitive measures of metacognitive competence. In a similar vein, Wellman (1983) has suggested that "effort allocation" constitutes a useful measure of metacognitive activity. Both Brown et al. and Wellman have argued that the task-related deployment of cognitive strategies requires the judicial allocation of cognitive effort which, in turn, implies the ability to monitor one's cognitive needs.

Research, which may be interpreted as assessing "effort," has provided evidence that the allocation of effort is a

sensitive measure of metacognitive competence (Bisanz, Vesonder, & Voss, 1978; Brown & Smiley, 1978; Cultice, Somerville, & Wellman, 1983; Flavell, Friedrichs, & Hoyt, 1970; Masur, McIntyre, & Flavell, 1973; Posnansky, 1978; Pressley, Levin, & Ghatala, 1984; Rogoff, Newcombe, & Kagan, 1974; Wellman 1977b). There are several relevant themes in this research. First, even preschool children are capable of allocating effort appropriately in some tasks (Cultice et al., 1983; Wellman, 1977b). Wellman (1977b) found that if kindergarten children thought they knew the name of an object they would invest more effort in trying to remember it's name than if they admitted not knowing an object's name. Second, in rote recall experiments, children younger than 7-years-old appear not to adjust their effort to fit the demands of the task (Flavell et al., 1970; Masur et al., 1973; Rogoff et al., 1974). Rogoff et al. (1974) have reported that, in contrast to older children, 6-year-old's do not adjust their study effort as a function of the time they are told they will have to remember between study and test.

Recently, Wellman, Collins, and Gleiberman (1981) have shown that even nursery school children report that more effort is required to remember items over an extended time interval than over a short time interval. Of course, possessing knowledge does not mean it will be used. Nevertheless, the work of Wellman and his colleagues suggests that in some circumstances young children are capable of adjusting their effort to meet task requirements.

The aim of the present study was to evaluate the claim that the deliberate use of mnemonic and metacognitive skills, as indexed by time spent studying, emerges in the context of meaningful activities. Five-year-olds watched a simple science demonstration, following which they were given a set of pictures to study and were told either to remember the names of the depicted items for a memory test, or to learn the names of the items because they were needed for a second science demonstration. All strategic activity was noted along with the amount of time children spent studying before indicating they had finished learning. Further, children were tested either immediately or after a delay to see whether degree of strategic activity, or study effort, as indexed by the time spent learning, was affected by delay interval. If Istomina's claims are correct children who believe they are studying items needed for a science demonstration should not only remember more items, but should also use mnemonic strategies more frequently and study longer before judging learning to be complete.

Experiment 1

Method

Subjects. Ninety-six 5-year-old children who attended a kindergarten class in one of three parochial elementary schools in a medium-sized city, served as subjects. An approximately equal number of boys and girls participated, and the overall mean age of the children was 5 years 9 months.

Materials. In the science demonstration the following materials were used: (a) a box of matches; (b) a piece of paper; (c) a narrow neck bottle; and (d) a shelled hard-boiled egg. The memory materials comprised a set of 10 2 x 2 inch colored picture cards, each depicting a single object. The cards illustrated the following objects: a knife, a cup, a book, a candle, a pencil, a piece of string, a watch, an apple, a small cardboard box, and a rubber band.

Design. The design was a 3 (Memory Condition: Embedded, Rote, or Incidental) x 2 (Delay Interval between learning and test: None, or 1 Hour) factorial. Sixteen children were assigned randomly to each of the 6 conditions.

Procedure. All children were tested individually. On arrival at the testing location children were asked if they would like to see a "science experiment." This involved setting alight the piece of paper, dropping the lighted paper into the bottle, and quickly placing the shelled boiled egg on the neck of the bottle. The vacuum created in the bottle by the lighted paper exhausting the oxygen, resulted in the egg being "sucked" into the bottle.

Following the science demonstration, children were randomly allocated to one of three memory groups; half the children in each group had their memory tested immediately, and the remaining children were tested after a delay of one hour. The embedded memory groups were told they would be collecting material from

the school store for a second science demonstration. The rote memory groups were told they would have to learn for a memory test. The incidental memory control groups were asked to look at the pictures, and after they had examined them all very carefully, to tell the experimenter whether they thought they had seen any of the pictures anywhere before.

The incidental memory group was included as a control to see whether subject's behavior in this group differed from the behavior of children in the intentional memory groups. Wellman (1977a) has pointed out that young children sometimes engage in strategy-like behavior when they are instructed to simply look at material, and this type of behavior should not be regarded as intentional strategic activity.

With the exception of the incidental memory groups, all subjects were told that their memory would be examined either immediately or at recess (a 1 hour delay) prior to being given the picture cards to study. Children were given the picture cards to study for 2 minutes, and their study behaviors were videotaped over this period. If a child claimed to have learned the names of the pictures sufficiently well prior to the elapse of 2 minutes, or were distracted for 20 seconds continuously, they were encouraged to continue studying the pictures. Following the study period, children were either sent to the school store to be tested or sent back to their classroom and asked to return to the store at recess. Children in the

incidental memory groups were asked to go to the school store, but were not given a reason for the request. At the time of test, when children recalled the name of an object, they were given that object. All children actually saw a second science experiment.

Dependent measures and interrater agreement. In addition to children's recall performance, both learning time and strategy-use were assessed. Learning time was determined by measuring the interval from task presentation until the child was either distracted for 20 seconds continuously or indicated he/she had learned the items sufficiently well and was ready to leave. Strategic activity was scored from the videotapes every 10 seconds by two separate raters for the entire 2 minute study period (raters agreed 92% of the time, and rating differences were resolved through discussion). The "strategy activity" categories were based primarily on those developed by Moely, Olson, Halwes, and Flavell (1969) (self-testing, grouping pictures, verbalizing or naming pictures, counting, and being distracted), although it was necessary to include an additional category of "looking" at the pictures. For the purposes of analyses, self-testing, grouping pictures, and verbalizing or naming the pictures were designated "active strategies" as these represent classic mnemonic strategies associated with active attempts to remember.

Results

Separate univariate analyses of variance were used to examine the three dependent measures, and the results of each analysis will be reported in turn.

Recall. The number of items correctly recalled at the school store varied as a function of both the memory group to which children belonged, $F(2,90) = 52.53$, $p < .0001$; and of the length time they had to remember items, $F(1,90) = 13.54$, $p < .001$. (Mean recall: Embedded groups = 6.06; Rote groups = 3.56; Incidental groups = 2.21; All Immediate test groups = 4.52; All Delay test groups = 3.38—see Table 1). The interaction between memory group and retention interval was also statistically significant, $F(2,90) = 5.64$, $p < .0005$.

Insert Table 1 about here.

Follow-up analyses using the Bonferroni procedure, suggest that the observed interaction is due to the significantly poorer recall of children in the embedded delay group compared with children in the embedded immediate group (means = 4.74 vs. 7.38 items recalled $p < .0001$). Although recall declined in the rote and in the incidental memory delay groups relative to the respective immediate recall groups, the decline was not statistically significant. These data, then, provide some support for the view that memory is enhanced by embedding the

memory task in a meaningful context. Unfortunately, this claim appears to be true only for the embedded immediate group, since children in the embedded delay group did not recall more items than children in the rote delay group. As will be seen from the analyses of the other dependent measures, it seems unlikely that the poor performance of children in the embedded delay group was due solely to forgetting.

Study time. The only factor that affected the length of time picture cards were studied prior to "learning being judged as complete," was the memory group to which children belonged (mean study time: Embedded groups = 65 secs; Rote groups = 40 secs; Incidental groups = 32 secs: $F(2,90) = 37.78$, $p < .0001$). Table 2 shows the mean study times for the six groups. Neither retention interval, nor the interaction between memory group and retention interval affected study time. These data provide support for the claim that more effort is expended in learning when information is embedded in a meaningful context. However, although there was a trend for children in the intentional delay groups to study longer than children in the intentional immediate groups, the difference was not statistically significant.

The "learning being complete" measure was defined in one of two ways; either children said they had finished, or they were distracted for 20 seconds continously. Thirty-four percent, 41%, and 63% of the embedded, rote, and incidental groups respectively were assessed as having "completed learning" because of being

distracted for 20 seconds continously. The correlation between the measure of "learning time" and recall was not assessed because all subjects were required to study for 2 minutes.

Insert Table 2 about here.

Strategies. The distribution of strategic activity as a function of memory group and retention interval is reported in Table 3. The occurrence of active strategy use (self-testing, grouping of pictures, and verbalizing) was assessed every 10 seconds and summed for the 2 minute study period; that is, if a child used one of these strategies in a 10 second interval, he or she was given a score of 1, and could obtain a maximum score of 12. Analysis of the strategy data showed that memory group membership was the only factor affecting the frequency of active strategy use (mean frequency of active strategy use over 2 minute study period: Embedded groups = 5.84; Rote groups = 3.84; Incidental groups = 2.22; $F(2,90) = 70.30$, $p < .0001$). This means that on almost 50% of the occasions assessed, the average "embedded" group child used at least one active strategy. Neither the length of time children had to wait before being tested, nor the interaction between memory group membership and retention interval affected frequency of active strategy use. Follow-up analyses using the Bonferroni procedure showed that the embedded groups exhibited more active strategy use than the rote

groups who, in turn, exhibited more active strategy use than the incidental groups ($p < .05$ for all comparisons). The pattern of these data are consistent with those observed for the study time data; children in the embedded groups appeared to engage in more effortful attempts to remember.

Insert Table 3 about here.

Discussion of Experiment 1

The results of Experiment 1 provide tentative support for the hypothesis that the deliberate use of mnemonic and metacognitive strategies first emerge in the context of everyday activities. Children in the embedded groups studied longer before judging learning to be complete, and engaged in more active strategy use than children in other groups. Unfortunately, the enhanced strategic effort did not translate into elevated recall for the embedded delay group. This puzzling finding could, of course, be due to forgetting associated with the extented retention interval. However, several pieces of evidence caution against accepting such a conclusion.

With the exception of the embedded delay group, the correlations between active strategy use and recall for all other groups was around .5 (range .44 to .64); it was .02 for the embedded delay group. These data suggest that some additional factor was influencing the recall of the embedded delay group. A

review of the videotapes of childrens' study behaviors suggested a plausible hypothesis. In contrast to children in the rote delay group, those in the embedded delay group seemed more aware of the difficulty of remembering over an extended retention interval, and this may have affected their recall. For example, in comparsion to children in other groups, children in the embedded delay group appeared to complain that they could not remember until recess and often appeared uncomfortable or anxious in the task; that is, it appeared that the perception of task difficulty disrupted effective cognitive processing. These impressions were investigated by reexamining the videotapes of all subjects for overt (verbal and non-verbal) signs of concern in the study period.

The procedure for assessing the occurrence of concern was identical to that used to assess the frequency of active strategy use (i.e., presence or absence of concern was assessed every 10 seconds, and summed over the 2 minute study period--different raters scored the concern and the strategy data). The raters, who were blind to the experimental treatments, were instructed to adopt a working definition of concern and note if a child appeared to be fearful, worried, tense, or voiced negative feelings in any 10 second study period. Raters only agreed 66% of the time, and disagreement was resolved through discussion.

The mean frequency of concern as a function of memory group membership and retention interval is shown in Table 4. Analysis

of these data showed that memory group membership affected concern, $F(2,90) = 5.18$, $p < .008$; but the interval over which children had to remember items did not, $F(1,90) < 1$. However, memory group membership and retention interval did interact in affecting level of concern $F(2,90) = 3.29$, $p < .05$. Follow-up analyses using the Bonferroni procedure, show that this interaction was due to the higher frequency of concern in the embedded delay group ($p < .05$ for all comparisons). However, the low frequency of concern (see Table 4), and the relatively poor interrater agreement as to what constitutes concern caution against a strong interpretation of these data.

Insert Table 4 about here.

In Experiment 1, children in the intentional memory groups knew exactly how long they would have to remember test items prior to receiving the picture cards. If, as proposed, knowledge of the extended retention interval affected the recall of children in the embedded delay group, omitting mention of the interval over which children would have to remember should both eliminate the concern factor which, in turn, should lead to elevated recall. This proposal was examined in Experiment 2.

Experiment 2

Method

Subjects. Fifty-six 5-year-old children, drawn from the same population source as used in Experiment 1, served as subjects. The sample comprised 30 boys and 26 girls, and the overall mean age of the children was 5 years 6 months.

Materials and procedure. The same set of materials and procedures used in Experiment 1 were used in Experiment 2 with one exception--children were not told how long they would have to remember the memory items. All children were told they would have to go to the school store to be tested; however, they were also informed that the experimenter had misplaced the key to the store. Children were told to return to their classroom, and the experimenter would fetch them when she found the key. The experimenter either fetched the child immediately, or after a 1 hour interval.

Design. The design was a 2 (Memory Condition: Embedded or Rote) x 2 (Delay interval between learning and test: None or 1 Hour) factorial. Fourteen children were assigned randomly to each of the 4 independent conditions.

Results

Recall. The mean recall performance for the four groups are presented in Table 1. Analysis of these data showed that children in the embedded groups recalled more than children in the rote groups, $F(1,52) = 54.71$, $p < .0001$. There was also a

marginally significant tendency for children to recall more when tested immediately than after a retention interval, $F(1,52) = 4.41$, $.04 > p < .05$. However, the interaction between memory group membership and retention interval was not significant ($F < 1$). Follow-up analyses using the Bonferroni procedure failed to reveal a significant decline in delayed recall as compared to immediate recall for either the embedded or the rote memory groups ($p > .05$). Nevertheless, all other comparisons between the embedded and the rote groups were statistically significant ($p < .05$). The improved performance of the embedded delay group in Experiment 2, provides support for the view that the poor recall of the embedded delay group in Experiment 1 was associate with their perception of the difficulty of remembering over an extended retention interval.

Study time. The average time each group spent studying before judging learning to be complete or before being distracted for 20 seconds continuously, is reported in Table 2. Analysis of the study time data showed that children in the embedded groups spent more time studying than children in the rote groups, $F(1,52) = 8.21$, $p < .007$ (mean study time: Embedded groups = 57 seconds; Rote groups = 42 seconds). However, no retention interval effect was observed, nor was there an interaction between memory group membership and retention interval (F's < 1). These null results are not surprizing since children were treated identically in the immediate and the delay test conditions, prior

to recall. Overall, the study time findings are consistent with those found in Experiment 1.

Active strategy use. The distribution of strategic activity as a function of memory group membership and of retention interval is reported in Table 5. The analysis of these data showed that the embedded groups ($\underline{M} = 5.2$) engaged in active strategy use more frequently than children in the rote groups ($\underline{M} = 3.2$), $\underline{F}(1,52) = 23.14$, $\underline{p} < .0001$. There was no effect due to retention interval, nor was there an interaction between memory group membership and retention interval ($\underline{F}$'s < 1). These results replicate those found in Experiment 1.

Insert Table 5 about here.

Concern. The average frequency of concern for the four groups is reported in Table 4. No statistically significant effects emerged from an analysis of the data. In contrast to Experiment 1, omitting mention of the retention interval over which children would have to remember appeared to have minimized children's concern. Finally, the correlations between active strategy use and recall were about .5 for all groups, including the embedded delay group (range .50 to .62).

General Discussion

The present research was designed to determine whether study behaviors and, by implication, recall performance, is affected by embedding a memory task in a meaningful context. In the first experiment, children who attempted to learn the names of ten objects required for a science experiment, studied longer and used active strategies more often than children who were merely told to learn the pictures for a memory test. Although children in the embedded memory groups exhibited memory-relevant study behaviors more frequently, this did not necessarily lead to superior recall; improved retention occurred only if memory was tested immediately, but not if tested after a delay. It was hypothesized that the relatively poor recall of the embedded delay group was due to their perception of the difficulty involved in remembering the items for one hour. This possibility was investigated in a second experiment in which children were not told how long they would have to remember. Under these conditions, the performance of the embedded delay and the embedded immediate groups was equivalent. These data were interpreted as evidence that the poor recall performance of the children in the embedded delay group in Experiment 1 was due to their perception of the difficulty of remembering for an extended time period.

Overall, the data are consistent with the hypothesis that the deliberate use of strategic behaviors to aid retention are

facilitated by meaningful, supportive contexts. Further, the finding that children in the embedded groups always studied longer than children in other memory groups before judging learning to be complete, supports the view that young children are capable of monitoring their own memory needs and adjusting their study behaviors accordingly (Brown et al., 1983; Wellman, 1983). Thus, these data show that, in contrast to the behaviors exhibited in classical memory tests, when a memory task is embedded in a supportive meaningful context, young children not only make more effort to learn, but they also use superior learning techniques.

However, independent of memory group membership, most children appeared to use some "active" strategies, suggesting they were deliberately attempting to remember the names of the objects. Some caution needs to be exercised in interpreting the meaning of this finding because, as Wellman (1977a) pointed out, children sometimes engage in strategy-like behaviors when instructed to look at stimuli. For some categories of strategic activity, such as "naming," Wellman's point is well taken; it is difficult to determine whether "naming" reflects a deliberate attempt to remember, or the spontaneous labelling of objects. From an inspection of Tables 3 and 5, however, it is clear that children in the intentional memory groups not only engaged in "naming" more often than children in the incidental groups, but were also observed to use mnemonic behaviors not recorded in the

incidental groups (e.g., self testing, grouping of pictures). These data provide evidence that 5-year-old children do engage in deliberate attempts to remember in intentional memory tasks, but that the allocation of strategic effort is dependent on the nature of the task context.

The relatively constant relation between recall and strategy use (about .50 in both experiments) is consistent with a "levels of processing" view of memory (Craik & Lockhart, 1972; Naus & Halasz, 1979), in which it is argued that retention is less a function of the intent to remember than the type of cognitive processes engaged in. Of course, intention can guide one's metacognitive activity in helping select task-appropriate strategies (Brown et al., 1983; Flavell, 1981; Schmidt & Paris, 1984). However, the relation between mnemonic activity and recall is not always direct; the recall performance of the embedded delay group in Experiment 1 suggests that other factors may intervene and affect performance.

What are these other factors, and how might they affect performance? In order to consider possible answers to these questions, it may help to refocus on the function of familiar meaningful tasks for young children. In contrast to the typical memory test, meaningful task contexts may provide support for cognitive operations in at least one of three ways (Reeve, 1985). First, individuals are more likely to be knowledgeable about such tasks which, in turn, is likely to enhance cognitive processing

(Chi, 1981). Second, the goal or purpose of the task is clear, and this is also likely to foster cognitive activity (Paris, 1978). Thus, familiar tasks are likely to provide a schema or a scaffold for cognitive processing, in contrast to classic memory tests where individuals have to construct the scaffold for themselves. Third, meaningful tasks often include a motivational and affective components which may effect performance significantly (Paris & Cross, 1983). Although several recent models of metacognition have included affective components (Brown et al., 1983; Flavell, 1981; Wellman, 1983), their role in problem solving has yet to be explained.

The above discussion lends itself to a possible interpretation of the performance of the embedded delay group in Experiment 1. Telling children they were learning names of objects needed for a second science experiment fulfilled its objective, in that it elevated both strategy use and study effort. However, as Mischel (1981) has observed, young children often engage in incompatible behaviors in contexts where "delay of gratification" is involved. In Experiment 1 it appeared that children in the embedded delay group engaged in two conflicting behaviors: they invested effort in remembering and also worried about forgetting, not only in the study period, but also probably in the retention interval itself. Thus fear of forgetting interfered with the effectiveness of strategic processing.

However, this interpretation, as such, does not explain why children in the rote delay group did not suffer from similar "cognitive interference." Several factors already alluded to may help to explain the differences in behavior between the groups. First, in contrast to the rote groups, for the embedded groups the purpose of remembering the objects was clear, providing children with a scaffold for thinking about the task. Under these conditions it is possible that young children were more sensitive to their own competence which, in turn, may have led the embedded delay group to worry about the difficulty of remembering over an extended interval.

Of course, the motivation to see a second science experiment may have had the same effect; that is, motivation might have heightened children's sensitivity to the difficulties associated with remembering. A related possibility is that children in the embedded delay groups were more "concerned" because they were aware of the social consequences of forgetting since they were collecting objects for another person for a definite event (a second science experiment).

In conclusion, the research reported in this paper examined the effect of task context of the recall and study techniques of young elementary school children. Five-year-old children can use task-appropriate strategies if the memory task is embedded in a purposeful, motivating activity. This finding is consistent with the claims made for Istomina's (1948/1975) research. However, an

increase in strategic effort did not always translate into increased recall, particularly when children had to remember over an extended retention interval. Awareness of one's own competence, facilitated by performing a motivating task, may also give rise to doubts about one's competence which, in turn, can affect performance negatively. Although the interdependencies of metacognition, motivation, and affect are at the heart of cognitive development (Paris & Cross, 1983; Reeve & Brown, 1985), it is clear that more attention needs to be paid to how these factors interact with one another in affecting performance.

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Table 1

Mean Recall Scores

Retention Interval	Embedded M	Embedded SD	Rote M	Rote SD	Incidental M	Incidental SD
			Experiment 1[a]			
Immediate	7.38	(1.5)	3.80	(1.3)	2.44	(1.3)
Delay	4.80	(2.1)	3.38	(1.5)	2.00	(1.2)
			Experiment 2[b]			
Immediate	6.80	(1.4)	4.14	(1.4)	-	
Delay	6.21	(1.3)	3.10	(1.8)	-	

Note. Maximum score = 10.

[a]Number of children in each group = 16.

[b]Number of children is each group = 14.

Table 2

Mean Study Time

Retention Interval	Memory Group: Embedded M	SD	Rote M	SD	Incidental M	SD
			Experiment 1[a]			
Immediate	60.00	(20.90)	35.94	(13.07)	33.50	(12.90)
Delay	70.94	(19.19)	43.12	(16.00)	31.38	(13.30)
			Experiment 2[b]			
Immediate	58.14	(26.30)	40.00	(13.80)	-	
Delay	57.00	(20.72)	39.10	(16.20)	-	

Note. Maximum score = 10

[a]Number of children in each group = 16.

[b]Number of children in each group = 14.

Table 3

Experiment 1: Mean Percentage of Strategic Activities

	Memory Group					
Strategic	Embedded		Rote		Incidental	
Activity	Immed.	Delay	Immed.	Delay	Immed.	Delay
Self Test	9	6	3	3	0	0
Grouping	17	15	12	15	9	8
Naming	23	26	17	15	10	12
Looking	26	29	27	32	32	29
Counting	3	3	9	6	4	3
Distracted	21	20	31	28	45	48

Note. Strategic activity was assessed every 10 seconds and summed for the 2 minute study period. Number of children in each group = 16.

Table 4

Mean Frequency of Expressed Concern

Retention Interval	Embedded M	Embedded SD	Rote M	Rote SD	Incidental M	Incidental SD
			Experiment 1[a]			
Immediate	1.19	(1.05)	1.25	(1.44)	0.81	(1.11)
Delay	2.50	(2.53)	0.88	(1.26)	0.56	(0.73)
			Experiment 2[b]			
Immediate	1.00	(1.18)	1.20	(1.00)	-	
Delay	1.14	(1.17)	0.76	(0.60)	-	

Note. Presence versus absence of concern about remembering the items was assessed every 10 seconds and summed over the 2 minute study period; thus maximum concern score = 12.

[a]Number of children in each group = 16.

[b]Number of children in each group = 14.

Table 5

Experiment 2: Mean Percentage of Strategic Activities

	Memory Group			
Strategic	Embedded		Rote	
Activity	Immed.	Delay	Immed.	Delay
Self Test	10	13	5	3
Grouping	16	22	9	11
Naming	28	22	20	23
Looking	25	18	27	30
Counting	1	5	5	5
Distracted	20	20	35	29

Note. Strategic activity was assessed every 10 seconds and summed for the 2 minute study period. Number of children in each group = 14.